Abstract for Consideration at the 42nd AIAA Aerospace Sciences Meeting

An Experimental Investigation of Hypergolic Ignition Delay of Hydrogen Peroxide with Fuel Mixtures

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An experimental evaluation of decomposition and ignition delay of hydrogen peroxide at concentrations of 80% to 98% with combinations of hydrocarbon fuels, tertiary amines and transition metal chelates will be presented in the proposed paper. The results will be compared to hydrazine ignition delays with hydrogen peroxide and nitric acid mixtures using the same test apparatus.

There has been a renewed interest in lowering the toxicity of the in-space propulsion over the last several years, with emphasis on reusable propulsion applications such as orbital maneuvering system (OMS) and reaction control system (RCS) propulsion for future vehicle operations. Lower toxicity would afford easier pre-launch and return processing and operations.

The ongoing experimental effort utilizes drop testing to determine the rates for decomposition and ignition. Figure 1 illustrates the experimental setup.

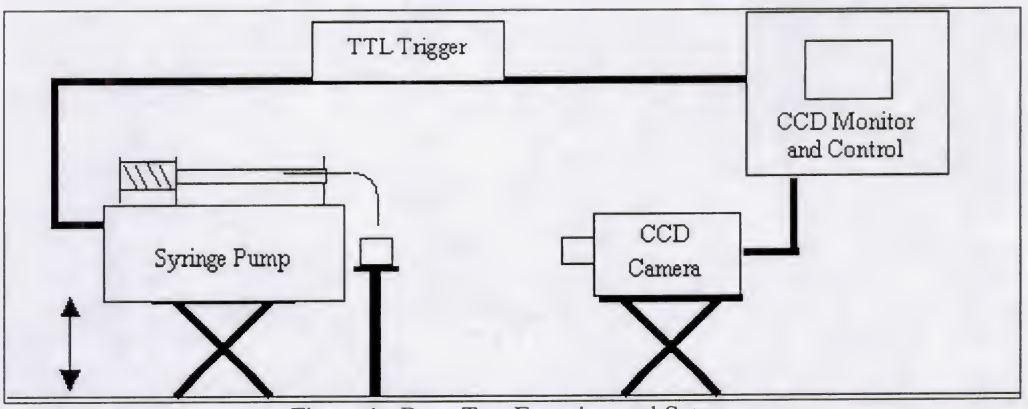

Figure 1. Drop Test Experimental Setup.

Example data are shown in Figure 2 with time presented in milliseconds (ms) below each image with respect to the drop contact at the base of the cuvette.

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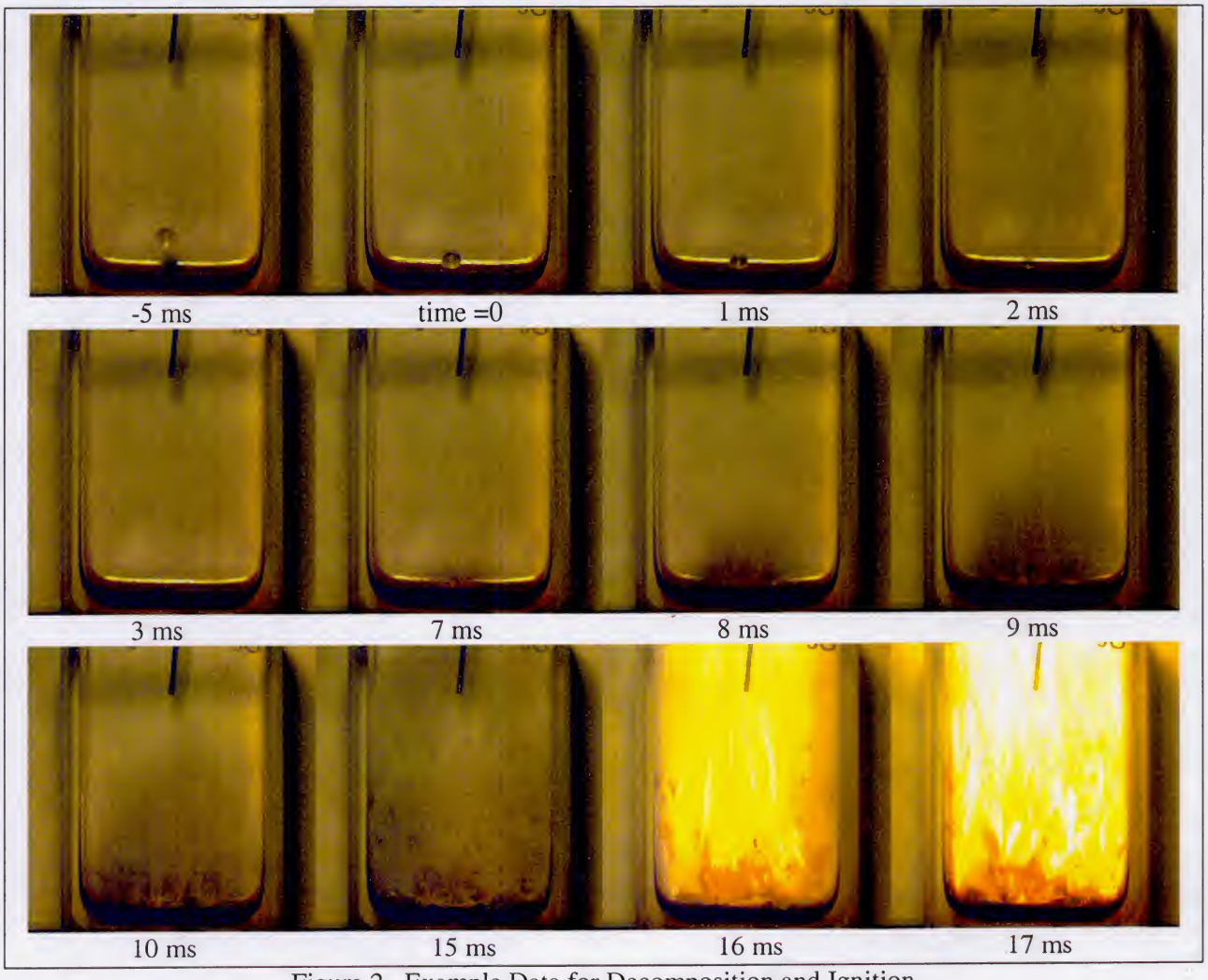

Figure 2. Example Data for Decomposition and Ignition

Important events such as drop contact with the base of the cuvette (time = 0), onset of decomposition (7 ms), and ignition (16 ms) are visually identified from the data.

The present experimental setup has provided better experimental uncertainty than many former studies. The precision uncertainty of the present setup is shown to be on the order of 7% to 10%, depending on the fuel blend being evaluated. It is likely that the current setup has more replicable heat transfer and fluid mechanics due to the size of drop and pool volume selected when compared to most previous studies. A discussion of the history of drop testing techniques and the uniqueness of the current setup will be presented in the proposed paper.